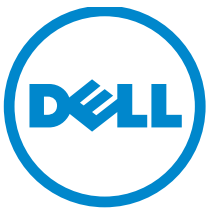
Users' Guide for the Programmable MUX (PMUX) on the M I/O Aggregator

Dell Networking OS version 9.3(0.0)



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Introduction

This document provides configuration instructions and examples for the Programmable MUX (PMUX mode) for the Dell Networking M I/O Aggregator using Dell Networking OS version 9.3(0.0). This document includes the following Programmable MUX features:

- Programmable MUX (PMUX)
  - Multiple uplink link aggregation group (LAGs)
    - 10G member ports
    - 40G member ports
  - Uplink failure detection (UFD)
  - Virtual local area network (VLAN) configurations on a physical port/port-channel
  - Virtual link trunking (VLT)
  - Stacking
  - N-port identifier virtualization (NPIV)

NOTE: For more information, refer to the *M IO Aggregator Command Line Interface for Dell Networking OS Version 9.2(0.2)/9.2(0.0)* and the *M IO Aggregator Configuration Guide for Dell Networking OS Version 9.2(0.2)/9.2(0.0).*

I/O Aggregator (IOA) Programmable MUX (PMUX) Mode

IOA PMUX is a mode that provides flexibility of operation with added configurability. This involves creating multiple LAGs, configuring VLANs on uplinks and the server side, configuring data center bridging (DCB) parameters, and so forth.

By default, IOA starts up in IOA Standalone mode. You can change to PMUX mode by executing the following commands and then reloading the IOA. After the IOA reboots, the IOA operates in PMUX mode. PMUX mode supports both stacking and VLT operations.

Configuring and Changing to PMUX Mode

After the IOA is operational in the default Standalone mode:

1. Connect the terminal to the console port on the IOA to access the CLI and enter the following commands:

```
Login: username
Password: *****
Dell> enable
Dell#
Dell#show system stack-unit 0 iom-mode
```

```
Unit Boot-Mode Next-Boot
------------------------------------------------
0 standalone standalone
Dell#
```

2. Change IOA mode to PMUX mode.

```
Dell(conf)# stack-unit 0 iom-mode programmable-mux
```

Where `stack-unit 0` defines the default stack-unit number.

3. Delete the startup configuration file.

```
Dell# delete startup-config
```

4. Reboot the IOA by entering the `reload` command.

```
Dell# reload
```

5. Repeat the above steps for each member of the IOA in PMUX mode.

After system is up, you can see the PMUX mode status:

```
Dell#sh system stack-unit 0 iom-mode
Unit    Boot-Mode               Next-Boot
------------------------------------------------
0        programmable-mux       programmable-mux
Dell#
```

The IOA is now ready for PMUX operations.

Configuring the Commands without a Separate User Account

Starting with Dell Networking OS version 9.3(0.0), you can configure the PMUX mode CLI commands without having to configure a new, separate user profile. The user profile you defined to access and log in to the switch is sufficient to configure the PMUX mode commands.

The IOA PMUX Mode CLI Commands section lists the PMUX mode CLI commands that you can now configure without a separate user account.

Multiple Uplink LAGs

Unlike IOA Automated modes (Standalone, VLT, and Stacking Modes), the IOA Programmable MUX can support multiple uplink LAGs. You can provision multiple uplink LAGs.

Note: In order to avoid loops, only disjoint VLANs are allowed between the uplink ports/uplink LAGs and uplink-to-uplink switching is disabled.

Multiple Uplink LAGs with 10G Member Ports

The following sample commands configure multiple dynamic uplink LAGs with 10G member ports based on LACP.

1. Bring up all the ports.

```
Dell#configure
Dell(conf)#int range tengigabitethernet 0/1 - 56
Dell(conf-if-range-te-0/1-56)#no shutdown
```

2. Associate the member ports into LAG-10 and 11.

```
Dell#configure
Dell(conf)#int range tengigabitethernet 0/41 - 42
Dell(conf-if-range-te-0/41-42)#port-channel-protocol lacp
Dell(conf-if-range-te-0/41-42-lacp)#port-channel   10   mode
active
Dell(conf-if-range-te-0/41-42-lacp)#end
Dell#

Dell#configure
Dell(conf)#int tengigabitethernet 0/43
Dell(conf-if-te-0/43)#port-channel-protocol lacp
Dell(conf-if-te-0/43-lacp)#port-channel 11 mode active
Dell(conf-if-te-0/43-lacp)#end
Dell#
```

3. Show the LAG configurations and operational status.

```
Dell#show interface port-channel brief
Codes: L - LACP Port-channel
       O - OpenFlow Controller Port-channel
    LAG  Mode  Status       Uptime      Ports
L   10   L3    up           00:01:00    Te 0/41    (Up)
                                        Te 0/42    (Up)
L   11   L3    up           00:00:01    Te 0/43    (Up)
Dell#
```

4. Configure the port mode, VLAN, and so forth on the port-channel.

```
Dell#configure
Dell(conf)#int port-channel 10
Dell(conf-if-po-10)#portmode hybrid
Dell(conf-if-po-10)#switchport
Dell(conf-if-po-10)#vlan tagged 1000
Dell(conf-if-po-10)#link-bundle-monitor enable

Dell#configure
Dell(conf)#int port-channel 11
Dell(conf-if-po-11)#portmode hybrid
Dell(conf-if-po-11)#switchport
Dell(conf-if-po-11)#vlan tagged 1000
% Error: Same VLAN cannot be added to more than one uplink
port/LAG.
Dell(conf-if-po-11)#vlan tagged 1001
Dell(conf-if-po-11)#link-bundle-monitor enable

Dell#show vlan

Codes: * - Default VLAN, G - GVRP VLANs, R - Remote Port
Mirroring VLANs, P - Primary, C - Community, I - Isolated
       O - Openflow
Q: U - Untagged, T - Tagged
   x - Dot1x untagged, X - Dot1x tagged
   o - OpenFlow untagged, O - OpenFlow tagged
   G - GVRP tagged, M - Vlan-stack, H - VSN tagged
   i - Internal untagged, I - Internal tagged, v - VLT
untagged, V - VLT tagged

    NUM    Status    Description         Q Ports
*   1      Active                        U Po10(Te 0/41-42)
                                         U Po11(Te 0/43)
    1000   Active                        T Po10(Te 0/41-42)
    1001   Active                        T Po11(Te 0/43)
Dell#
```

5. Show LAG member ports utilization.

```
Dell#show link-bundle-distribution
Link-bundle trigger threshold - 60

LAG bundle - 10   Utilization[In Percent] - 0   Alarm State
- Inactive

Interface      Line Protocol   Utilization[In Percent]
```

```
Te 0/41                  Up              0
Te 0/42                  Up              0

LAG bundle - 11   Utilization[In Percent] - 0   Alarm State
- Inactive

Interface      Line Protocol   Utilization[In Percent]
Te 0/43                  Up              0
Dell#
```

Multiple Uplink LAGs with 40G Member Ports

By default in IOA, native 40G QSFP+ optional module ports are used in Quad (4x10G) mode, to convert Quad mode to Native 40G mode, refer to the sample configuration. Also note, converting between Quad mode and Native mode, and vice versa, requires that you reload the system for the configuration changes to take effect.

The following sample commands configure multiple dynamic uplink LAGs with 40G member ports based on LACP.

1. Convert the quad mode (4x10G) ports to native 40G mode.

```
Dell#configure
Dell(conf)#no stack-unit 0 port 33 portmode quad
Disabling quad mode on stack-unit 0 port 33 will make interface
configs of Te 0/33 Te 0/34 Te 0/35 Te 0/36 obsolete after a save
and reload.
[confirm yes/no]:yes
Please save and reset unit 0 for the changes to take effect.

Dell(conf)#no stack-unit 0 port 37 portmode quad
Disabling quad mode on stack-unit 0 port 37 will make interface
configs of Te 0/37 Te 0/38 Te 0/39 Te 0/40 obsolete after a save
and reload.
[confirm yes/no]:yes
Please save and reset unit 0 for the changes to take effect.

Dell(conf)#no stack-unit 0 port 49 portmode quad
Disabling quad mode on stack-unit 0 port 49 will make interface
configs of Te 0/49 Te 0/50 Te 0/51 Te 0/52 obsolete after a save
and reload.
[confirm yes/no]:yes
Please save and reset unit 0 for the changes to take effect.

Dell(conf)#no stack-unit 0 port 53 portmode quad
Disabling quad mode on stack-unit 0 port 53 will make interface
configs of Te 0/53 Te 0/54 Te 0/55 Te 0/56 obsolete after a save
and reload.
[confirm yes/no]:yes
```

```
Please save and reset unit 0 for the changes to take effect.
Dell(conf)#
```

2. Save the configuration.

```
Dell#write memory
!
01:05:48: %STKUNIT0-M:CP %FILEMGR-5-FILESAVED: Copied running-
config to startup-config in flash by default

Dell#reload
Proceed with reload [confirm yes/no]: yes
```

3. Configure the port-channel with 40G member ports.

```
Dell#configure
Dell(conf)#interface range fortygige 0/33, fortygige 0/37
Dell(conf-if-range-fo-0/33,fo-0/37)#no shut
Dell(conf-if-range-fo-0/33,fo-0/37)#port-channel-protocol lacp
Dell(conf-if-range-fo-0/33,fo-0/37-lacp)#port-channel 20 mode
active
Dell(conf)#

Dell(conf)#int fortygige 0/49
Dell(conf-if-fo-0/49)#port-channel-protocol lacp
Dell(conf-if-fo-0/49-lacp)#port-channel 21 mode active
Dell(conf-if-fo-0/49-lacp)#
Dell(conf-if-fo-0/49)#no shut
```

4. Configure the port mode, VLAN, and so forth on the port-channel.

```
Dell#configure
Dell(conf)#int port-channel 20
Dell(conf-if-po-20)#portmode hybrid
Dell(conf-if-po-20)#switchport
Dell(conf-if-po-20)#no shut
Dell(conf-if-po-20)#ex
Dell(conf)#int port-channel 21
Dell(conf-if-po-21)#portmode hybrid
Dell(conf-if-po-21)#switchport
Dell(conf-if-po-21)#no shut
Dell(conf-if-po-21)#end
Dell#
```

5. Show the port channel status.

```
Dell#sh int port-channel br
Codes: L - LACP Port-channel
       O - OpenFlow Controller Port-channel

    LAG  Mode  Status       Uptime      Ports
L   20   L2    up           00:00:53    Fo 0/33    (Up)
                                        Fo 0/37    (Up)
L   21   L2    up           00:00:02    Fo 0/49    (Up)
Dell#

Dell(conf)#int port-channel 20
Dell(conf-if-po-20)#vlan tagged 1000
Dell(conf-if-po-20)#

Dell(conf-if-po-21)#vlan tagged 1000
% Error: Same VLAN cannot be added to more than one uplink
port/LAG.
Dell(conf-if-po-21)#vlan tagged 1001
Dell(conf-if-po-21)#
```

6. Show the VLAN status.

```
Dell#show vlan

Codes: * - Default VLAN, G - GVRP VLANs, R - Remote Port
 Mirroring VLANs, P - Primary, C - Community, I - Isolated
       O - Openflow
Q: U - Untagged, T - Tagged
   x - Dot1x untagged, X - Dot1x tagged
   o - OpenFlow untagged, O - OpenFlow tagged
   G - GVRP tagged, M - Vlan-stack, H - VSN tagged
   i - Internal untagged, I - Internal tagged, v - VLT untagged,
V - VLT tagged

    NUM    Status    Description            Q Ports
*   1      Active                           U Po20(Fo 0/33,37)
                                            U Po21(Fo 0/49)
    1000   Active                           T Po20(Fo 0/33,37)
    1001   Active                           T Po21(Fo 0/49)
Dell#
```

Uplink Failure Detection (UFD)

UFD provides detection of the upstream connectivity loss and, if used with network interface controller (NIC) teaming, automatic recovery from a failed link.

1. Create the UFD group and associate the downstream and upstream ports.

```
Dell#configure
Dell(conf)#uplink-state-group 1
Dell(conf-uplink-state-group-1)#
Dell(conf-uplink-state-group-1)#upstream port-channel 128
Dell(conf-uplink-state-group-1)#downstream
tengigabitethernet 0/1-32
```

2. Show the running configurations in the UFD-group 1.

```
Dell(conf-uplink-state-group-1)#show config
!
uplink-state-group 1
downstream TenGigabitEthernet 0/1-32
upstream Port-channel 128
Dell(conf-uplink-state-group-1)#
```

3. Show the UFD status.

```
Dell#show uplink-state-group detail

(Up): Interface up   (Dwn): Interface down   (Dis):
Interface disabled
Uplink State Group    : 1       Status: Enabled, Up
Upstream Interfaces   : Po 128(Up)
Downstream Interfaces : Te 0/1(Dwn) Te 0/2(Dwn) Te 0/3(Dwn)
Te 0/4(Up) Te 0/5(Up)
                        Te 0/6(Dwn) Te 0/7(Up) Te 0/8(Dwn)
Te 0/9(Dwn) Te 0/10(Dwn)
                        Te 0/11(Dwn) Te 0/12(Up) Te
0/13(Up) Te 0/14(Dwn)   Te 0/15(Up)
                        Te 0/16(Dwn) Te 0/17(Dwn) Te
0/18(Dwn) Te 0/19(Dwn)  Te 0/20(Dwn)
                        Te 0/21(Dwn) Te 0/22(Dwn) Te
0/23(Dwn) Te 0/24(Dwn)  Te 0/25(Dwn)
                        Te 0/26(Dwn) Te 0/27(Dwn) Te
0/28(Dwn) Te 0/29(Dwn)  Te 0/30(Dwn)
                        Te 0/31(Dwn) Te 0/32(Dwn)
Dell#
```

NOTE: In this example, if port-channel 128 goes down, the downstream interfaces are brought operationally down (set to UFD `error-disabled`). Similarly, if the upstream port-channel goes up, the downstream ports are brought up (cleared from UFD `error-disabled`).

VLAN Configuration on Physical Ports and Port-Channels

Unlike other Dell Networking OS platforms, IOA allows VLAN configurations on port and port-channel levels. This allows you to assign VLANs to a port/port-channel.

Note: In PMUX mode, In order to avoid loops, only disjoint VLANs are allowed between the uplink ports/uplink LAGs and uplink-to-uplink switching is disabled.

1. Initialize the port with configurations such as admin up, portmode, and switchport.

```
Dell#configure
Dell(conf)#int tengigabitethernet 0/1
Dell(conf-if-te-0/1)#no shutdown
Dell(conf-if-te-0/1)#portmode hybrid
Dell(conf-if-te-0/1)#switchport
```

2. Configure the tagged VLANs 10 through 15 and untagged VLAN 20 on this port.

```
Dell(conf-if-te-0/1)#vlan tagged 10-15
Dell(conf-if-te-0/1)#vlan untagged 20
Dell(conf-if-te-0/1)#
```

3. Show the running configurations on this port.

```
Dell(conf-if-te-0/1)#show config
!
interface TenGigabitEthernet 0/1
portmode hybrid
switchport
vlan tagged 10-15
vlan untagged 20
no shutdown
Dell(conf-if-te-0/1)#end
Dell#
```

4. Initialize the port-channel with configurations such as admin up, portmode, and switchport.

```
Dell#configure
Dell(conf)#int port-channel 128
Dell(conf-if-po-128)#portmode hybrid
Dell(conf-if-po-128)#switchport
```

5. Configure the tagged VLANs 10 through 15 and untagged VLAN 20 on this port-channel.

```
Dell(conf-if-po-128)#vlan tagged 10-15
Dell(conf-if-po-128)#
Dell(conf-if-po-128)#vlan untagged 20
```

6. Show the running configurations on this port-channel.

```
Dell(conf-if-po-128)#show config
!
interface Port-channel 128
portmode hybrid
switchport
vlan tagged 10-15
vlan untagged 20
shutdown
Dell(conf-if-po-128)#end
Dell#
```

7. Show the VLAN configurations.

```
Dell#show vlan

Codes: * - Default VLAN, G - GVRP VLANs, R - Remote Port
Mirroring VLANs, P - Primary, C - Community, I - Isolated
       O - Openflow
Q: U - Untagged, T - Tagged
   x - Dot1x untagged, X - Dot1x tagged
   o - OpenFlow untagged, O - OpenFlow tagged
   G - GVRP tagged, M - Vlan-stack, H - VSN tagged
   i - Internal untagged, I - Internal tagged, v - VLT
untagged, V - VLT tagged

    NUM    Status    Description        Q Ports
*   1      Active                       U Te 0/33
    10     Active                       T Po128(Te 0/41-42)
                                        T Te 0/1
    11     Active                       T Po128(Te 0/41-42)
```

```
                                          T Te 0/1
    12     Active                         T Po128(Te 0/41-42)
                                          T Te 0/1
    13     Active                         T Po128(Te 0/41-42)
                                          T Te 0/1
    14     Active                         T Po128(Te 0/41-42)
                                          T Te 0/1
    15     Active                         T Po128(Te 0/41-42)
                                          T Te 0/1
    20     Active                         U Po128(Te 0/41-42)
                                          U Te 0/1
Dell#
```

You can remove the inactive VLANs that have no member ports using the following command:

```
Dell#configure
Dell(conf)#no interface vlan <vlan-id>
```

->vlan-id - Inactive VLAN with no member ports

You can remove the tagged VLANs using the `no vlan tagged <VLAN-RANGE>` command. You can remove the untagged VLANs using the `no vlan untagged` command in the physical port/port-channel.

Virtual Link Trunking (VLT) in PMUX Mode

VLT allows the physical links between two devices (known as VLT nodes or peers) within a VLT domain to be considered a single logical link to connected external devices.

For VLT operations, use the following configurations on both the primary and secondary VLT. Ensure the VLTi links are connected and administratively up. VLTi connects the VLT peers for VLT data exchange.

1. Configure VLTi.

```
Dell#configure
Dell(conf)#int port-channel 127
Dell(conf-if-po-127)# channel-member fortygige 0/33,37
Dell(conf-if-po-127)# no shutdown
Dell(conf-if-po-127)# end
```

2. Configure the VLT domain.

```
Dell#configure
Dell(conf)#vlt domain 1
Dell(conf-vlt-domain)# peer-link port-channel 127
-> VLT peer destination
Dell(conf-vlt-domain)# back-up destination 169.254.31.23
Dell(conf-vlt-domain)#system-mac mac-address
00:01:09:06:06:06
-> unit-id 0 – VLT Primary, unit-id 1 – VLT Secondary
Dell(conf-vlt-domain)# unit-id 0
Dell(conf-vlt-domain)#end
```

3. Configure the VLT port channel. In the following example, the local and remote VLT port-channels are the same but you can also use different VLT port-channels.

```
Dell#configure
Dell(conf)#int port-channel 128
Dell(conf-if-po-128)# portmode hybrid
Dell(conf-if-po-128)# switchport
Dell(conf-if-po-128)# vlt-peer-lag port-channel 128
Dell(conf-if-po-128)# link-bundle-monitor enable
Dell(conf-if-po-128)# no shutdown
Dell(conf-if-po-128)# end
```

4. Show the VLT peer status.

```
Dell#show vlt brief
VLT Domain Brief
------------------
Domain ID:                      1
Role:                           Primary
Role Priority:                  32768
ICL Link Status:                Up
HeartBeat Status:               Up
VLT Peer Status:                Up
Local Unit Id:                  0
Version:                        6(2)
Local System MAC address:       00:01:e8:e1:e1:c3
Remote System MAC address:      f8:b1:56:0e:b1:7f
Configured System MAC address:  00:01:09:06:06:06
Remote system version:          6(2)
Delay-Restore timer:            90 seconds
Peer-Routing :                  Disabled
Peer-Routing-Timeout timer:     0 seconds
Multicast peer-routing timeout: 150 seconds
```

```
Dell#
```

5. Configure the secondary VLT.

NOTE: Repeat steps from 1 through 4 on the secondary VLT, ensuring you use the different backup destination and unit-id.

```
Dell#show vlt brief
VLT Domain Brief
------------------
Domain ID:                      1
Role:                           Secondary
Role Priority:                  32768
ICL Link Status:                Up
HeartBeat Status:               Up
VLT Peer Status:                Up
Local Unit Id:                  1
Version:                        6(2)
Local System MAC address:       f8:b1:56:0e:b1:7f
Remote System MAC address:      00:01:e8:e1:e1:c3
Configured System MAC address:  00:01:09:06:06:06
Remote system version:          6(2)
Delay-Restore timer:            90 seconds
Peer-Routing :                  Disabled
Peer-Routing-Timeout timer:     0 seconds
Multicast peer-routing timeout: 150 seconds
Dell#

Dell#show vlt detail
Local  LAG  Id   Peer  LAG  Id   Local  Status   Peer  Status
Active VLANs
------------------  ------------  -----------  ----------
128           128          UP            UP            1
Dell#
```

Stacking in PMUX Mode

PMUX stacking allows the stacking of two or more IOA units. This allows grouping of multiple units for high availability. IOA supports a maximum of six stacking units.

NOTE: Prior to configuring the stack-group, ensure the stacking ports are connected and in 40G native mode.

1. Configure stack groups on all stack units.

```
Dell#
Dell#configure
Dell(conf)#stack-unit 0 stack-group 0
Dell(conf)#00:37:46: %STKUNIT0-M:CP %IFMGR-6-
STACK_PORTS_ADDED: Ports Fo 0/33  have been configured as
stacking ports. Please save and reset stack-unit 0 for
config to take effect

Dell(conf)#stack-unit 0 stack-group 1
Dell(conf)#00:37:57: %STKUNIT0-M:CP %IFMGR-6-
STACK_PORTS_ADDED: Ports Fo 0/37  have been configured as
stacking ports. Please save and reset stack-unit 0 for
config to take effect

Dell(conf)#end
Dell#00:38:16: %STKUNIT0-M:CP %SYS-5-CONFIG_I: Configured
from  console
```

2. Reload the stack units.

```
Dell#reload

Proceed with reload [confirm yes/no]: yes
```

3. Show the units stacking status.

```
Dell#show system brief

Stack MAC : 00:01:e8:e1:e1:c3
Reload-Type               :   normal-reload [Next boot :
normal-reload]

--  Stack Info  --
Unit  UnitType     Status         ReqTyp          CurTyp
Version     Ports
-----------------------------------------------------------
  0   Management   online       I/O-Aggregator  I/O-
Aggregator  <<release version>>  56
  1   Standby      online       I/O-Aggregator  I/O-
Aggregator  <<release version>>  56
  2   Member       not present
  3   Member       not present
  4   Member       not present
  5   Member       not present
Dell#
```

N-Port Identifier Virtualization (NPIV) Proxy Gateway (NPG)

NPIV NPG feature provides Fibre Channel over Ethernet (FCoE)-FC bridging on the IOA and MXL 10/40GbE switch with the FC Flex IO module, allowing server-converged network access (CNA) to communicate with storage area network (SAN) fabrics. In NPIV mode, the FC/Ethernet split happens at the chassis edge, thus removing the need for an explicit external Fibre Channel forwarder (FCF).

To configure the IOA and MXL with the FC Flex IO modules to operate as an NPIV proxy gateway, use the following commands.

dcb-map

Create a DCB map to configure priority flow control (PFC) and enhanced transmission selection (ETS) on Ethernet ports that support converged Ethernet traffic. Apply the DCB map to an Ethernet interface.

Syntax	`dcb-map` *`map-name`*
Parameters	*`map-name`* = Enter a DCB map name. The maximum number of alphanumeric characters is 32. To remove a DCB map from an interface, enter the `no dcb-map map-name` command in Interface Configuration mode.
Defaults	None.
Command Modes	• CONFIGURATION • INTERFACE
Command History	Version 9.3(0.0)
Usage Information	Use the `dcb-map` command to specify PFC and ETS settings and apply them to Ethernet ports. After you apply a DCB map to an interface, the PFC and ETS settings in the map are applied when you enable the Ethernet port. DCBx is enabled by default. The `dcb-map` command is supported only on physical Ethernet interfaces.
Related Commands	• `show qos dcb-map` • `dcb-map stack-unit all stack-ports all`

description

Add a text description of the FCoE and FC parameters used to transmit storage traffic over an IOA and MXL switch with the FC Flex IO module NPIV proxy gateway in a converged fabric.

Syntax	`description text`
Parameters	`text` = Enter a maximum of 32 characters.
Defaults	None
Command Modes	FCOE MAP
Command History	Version 9.3(0.0)

Related Commands	• `fcoe-map` • `show fcoe-map`

fabric

Apply an FCoE map on a fabric-facing Fibre Channel (FC) port.

Syntax	`Fabric` *`map-name`*
Parameters	*`map-name`* = Enter a maximum of 32 alphanumeric characters. To remove an FCoE map from an FC interface, enter the `no fabric map-name` command in Interface Configuration mode.
Defaults	None
Command Modes	INTERFACE FIBRE_CHANNEL
Command History	Version 9.3(0.0)
Usage Information	After you apply an FCoE map on an FC interface, when you enable the port (`no shutdown`), the FC port will login to the FC equipment it is connected to; after login success, advertisements are sent to the server ports.
Related Commands	• `fcoe-map` • `interface fibrechannel` • `show fcoe-map`

fabric-id vlan

Configure the association between the dedicated VLAN (used to carry FCoE traffic between servers and a SAN) and the fabric storage arrays.

Syntax	`fabric-id` *`fabric-num`* `vlan` *`vlan-id`* To remove a fabric-VLAN association from an FCoE map, enter the `no fabric-id vlan` command.
Parameters	• `fabric-id` *`fabric-num`* = Enter a fabric ID number that is the same as the ID number of the dedicated VLAN. The range is from 1 to 4094. • `vlan` *`vlan-id`* = Enter the ID number of the dedicated VLAN.
Defaults	None
Command Modes	FCOE MAP
Command History	Version 9.3(0.0)

Usage Information	The fabric and VLAN ID numbers must be the same. However, in each FCoE map, the fabric ID, FC-MAP value, and FCoE VLAN parameters must be unique.
	You must first create a VLAN and then specify the configured VLAN ID in the `fabric-id vlan` command. Otherwise, the following error message displays:
	`FTOS(conf-fcoe-f)#fabric-id 10 vlan 10`
	`% Error: Vlan 10 does not exist`

Related Commands	• `fcoe-map` • `show fcoe-map`

fcf-priority

Configure the priority to select an upstream FCoE forwarder (FCF).

Syntax	`fcf–priority` *`priority`* To remove a configured FCF priority from an FCoE map, enter the `no fcf-priority` command.
Parameters	*`priority`* = Enter the fcf priority. The range is from 0 to 128.
Defaults	128
Command Modes	FCOE MAP
Command History	Version 9.3(0.0)
Usage Information	The FCF priority is used by the server CNAs to select an upstream FCF to use for a fabric login (FLOGI).
Related Commands	• `fcoe-map` • `show fcoe-map`

fc-map

Configure the FCoE mapped address prefix value used to identify FCoE traffic transmitted on the FCoE VLAN for the specified fabric.

Syntax	`fc–map` *`fc-map-value`* To remove a configured FC-MAP value from an FCoE map, enter the `no fc-map` command.
Parameters	*`fc-map-value`* = Enter the unique MAC address prefix used by a SAN fabric. The range is from 0EFC00 to 0EFCFF.
Defaults	None
Command Modes	FCOE MAP
Command History	Version 9.3(0.0)
Usage Information	In an FCoE map, the FC-MAP value, fabric ID, and FCoE VLAN parameters must be unique.
Related Commands	• `fcoe-map` • `show fcoe-map`

fcoe priority-bits

Configure the administrative values for advertised for the FCoE protocol in application priority TLVs.

Syntax	`fcoe priority-bits` *`priority-bitmap`* To remove the configured FCoE priority, use the `no fcoe priority-bits` command.

Parameters	*priority-bitmap* = Enter the priority-bitmap range. The range is from 1 to FF.
Defaults	0x8
Command Modes	PROTOCOL LLDP
Command History	Version 9.3(0.0)

fcoe-map

Configure the links between the server CNAs and a SAN fabric. Apply the FCoE map on a server-facing Ethernet port.

Syntax	`fcoe-map` *map-name* To remove an FCoE map from an Ethernet interface, enter the `no fcoe-map map-name` command in Interface configuration mode.
Parameters	*map-name* = Enter a maximum of 32 alphanumeric characters.
Defaults	None for the MXL switch. For the IOA, the following parameters are applied: • Description: SAN_FABRIC • Fabric-id: 1002 • Fcoe-vlan: 1002 • Fc-map: 0x0efc00 • Fcf-priority: 128 • Fka-adv-period: 8000mSec • Keepalive: enable • Vlan priority: 3
Command Modes	• CONFIGURATION • INTERFACE
Command History	Version 9.3(0.0)
Usage Information	In each FCoE map, the fabric ID, FC-MAP value, and FCoE VLAN parameters must be unique. Use one FCoE map to access one SAN fabric. You cannot use the same FCoE map to access different fabrics.
Related Commands	• `interface fibrechannel` • `show fcoe-map`

fka-adv-period

Configure the time used to transmit FIP keepalive (FKA) advertisements.

Syntax	`fka-adv-period` *seconds* To delete the FIP keepalive time period from an FCoE map, enter the `no fka-adv-period` command.
Parameters	*Seconds* = Enter the time period (in seconds) used to send FIP keepalive messages to peer devices. The range is from 8 to 90 seconds.

Defaults	8 seconds
Command Modes	FCOE MAP
Command History	Version 9.3(0.0)
Related Commands	• `fcoe-map` • `show fcoe-map`

interface vlan

Create a dedicated VLAN to be used to send and receive Fibre Channel traffic over FCoE links.

Syntax	`interface vlan` *`vlan-id`*
Parameters	*`vlan-id`* *= Enter a number as the VLAN Identifier. The range is 1 to 4094.*
Defaults	Not configured.
Command Modes	CONFIGURATION
Command History	Version 9.3(0.0)
Usage Information	You must configure a separate FCoE VLAN for each fabric to which FCoE traffic is forwarded. When you apply an FCoE map to a server-facing Ethernet port, the port is automatically configured as a tagged member of the FCoE VLAN. For more information about VLANs and the commands to configure them, refer to the *Virtual LAN (VLAN) Commands* section of the *Layer 2* chapter.
Example (Single Range)	`Dell(conf)#interface vlan 10` `Dell(conf-if-vl-10)#`
Related Commands	• `fcoe-map` • `show fcoe-map`

keepalive

Enable FIP keepalive message monitoring (if disabled).

Syntax	`Keepalive` To remove FIP keepalive monitoring from an FCoE map, enter the `no keepalive` command.
Parameters	None
Defaults	Enabled on Ethernet and FC interfaces.
Command Modes	FCOE MAP
Command History	Version 9.3(0.0)
Usage Information	Use FIP keepalive (FKA) messaging to detect if the other FCoE devices are reachable.
Related Command	• `fcoe-map` • `show fcoe-map`

Priority-pgid

Assign 802.1 priority traffic to a priority group in a DCB map.

Syntax	`priority-pgid dot1p0_group-num dot1p1_group-num dot1p2_group-num dot1p3_group-num dot1p4_group-num dot1p5_group-num dot1p6_group-num dot1p7_group-num` To remove a priority-pgid configuration from a DCB map, enter the `no priority-pgid` command.
Parameters	• *dotp0_group-num* = Enter the priority group number for each 802.1p class of traffic in a DCB map. • *dotp1_group-num* • *dotp2_group-num* • *dotp3_group-num* • *dotp4_group-num* • *dotp5_group-num* • *dotp6_group-num* • *dotp7_group-num*
Defaults	None
Command Modes	DCB MAP
Command History	Version 9.3(0.0)
Usage Information	PFC and ETS settings are not pre-configured on Ethernet ports. You must use the `dcb-map` command to configure different groups of 802.1p priorities with PFC and ETS settings. Using the `priority-pgid` command, you assign each 802.1p priority to one priority group. All 802.1p priorities mapped to the same queue must be in the same priority group.
Related Command	• dcb-map • priority-group bandwidth pfc

priority-group bandwidth pfc

Configure the ETS bandwidth allocation and PFC mode used to manage port traffic in an 802.1p priority group.

Syntax	`priority-group` *group-num* `{bandwidth` *percentage*`| strict-priority} pfc {on	off}` To remove a priority-group configuration in a DCB map, enter the `no priority-group bandwidth pfc` command.
Parameters	• `priority-group` *group-num* = Enter the keyword `priority-group` then the number of an 802.1p priority group. Use the `priority-pgid` command to create the priority groups in a DCB map. • `bandwidth` *percentage* = Enter the keyword `bandwidth` then a bandwidth percentage allocated to the

	priority group. The range is 1 to 100. The sum of all allocated bandwidth percentages in priority groups in a DCB map must be 100%. • `strict-priority` = Configure the priority-group traffic to be handled with strict priority scheduling. Strict-priority traffic is serviced first, before bandwidth allocated to other priority groups is made available. • `pfc {on | off}` = Configure whether priority-based flow control is enabled (on) or disabled (off) for port traffic in the priority group.
Defaults	None
Command Modes	DCB MAP
Command History	Version 9.3(0.0)
Usage Information	Use this command to configure PFC and ETS traffic handling for each priority group in a DCB map. You can enable PFC on a maximum of two priority queues. If you configure more than one priority group as strict priority, the higher numbered priority queue is given preference when scheduling data traffic. If a priority group does not use its allocated bandwidth, the unused bandwidth is made available to other priority groups. By default, equal bandwidth is assigned to each dot1p priority in a priority group. Use the bandwidth parameter to configure the bandwidth percentage assigned to a priority group. The sum of the bandwidth allocated to all priority groups in a DCB map must be 100% of the bandwidth on the link. You must allocate at least 1% of the total port bandwidth to each priority group.
Related Command	• `dcb-map` • `priority-pgid`

show fcoe-map

Display the Fibre Channel and FCoE configuration parameters in FCoE maps.

Syntax	`show fcoe-map [brief | map-name]`
Parameters	• `brief` = Displays an overview of currently configured FCoE maps. • *`map-name`* = Displays the FC and FCoE configuration parameters in a specified FCoE map. The FCoE map is applied on Ethernet (FCoE) and FC ports to transmit FC storage traffic to a specified fabric.
Command Modes	• EXEC

	• EXEC Privilege
Command History	Version 9.3(0.0)
Usage Information	Use this command to display the FC and FCoE parameters used to configure server-facing Ethernet (FCoE) and fabric-facing FC ports in all FCoE maps. In each FCoE map, the values for the fabric ID, FC-MAP, and FCoE VLAN must be unique.

Example	`Dell#show fcoe-map brief`
	
	`Fabric-Name Fabric-Id Vlan-Id FC-MAP FCF-Priority Config-State Oper-State`
	`test 16 16 0efc02 128 ACTIVE UP`
	`cnatest 1003 1003 0efc03 128 ACTIVE UP`
	`Sitest 1004 1004 0efc04 128 ACTIVE DOWN`
	
	`Dell#show fcoe-map si`
	
	`Fabric Name si`
	`Fabric Id 1004`
	`Vlan Id 1004`
	`Vlan priority 3`
	`FC-MAP 0efc04`
	`FKA-ADV-Period 8`
	`Fcf Priority 128`
	`Config-State ACTIVE`
	`Oper-State DOWN`
	`Members`
	See the following tables for field descriptions.

Related Command	• `fcoe-map`

The following table describes the `show fcoe-map brief` output.

Field	**Description**
Field-Name	Name of a SAN fabric.
Fabric ID	The ID number of the SAN fabric to which FC traffic is forwarded.
VLAN ID	The dedicated FCoE VLAN used to transport FCoE storage traffic between servers and a fabric over the NPIV proxy gateway. The configured VLAN ID must be the same as the fabric ID.
FC-MAP	FCoE MAC address-prefix value - The unique 24-bit MAC address prefix that identifies a fabric.
FCF Priority	The priority used by a server to select an upstream FCoE forwarder.
Config-State	Indicates whether the configured FCoE and FC parameters in the FCoE map are valid:

	Active (all mandatory FCoE and FC parameters are correctly configured) Incomplete (either the FC-MAP value, fabric ID, or VLAN ID are not correctly configured).
Oper-State	Operational status of link to the fabric: Up (link is up and transmitting FC traffic) Down (link is down and not transmitting FC traffic) Link-wait (link is up and waiting for FLOGI to complete on peer FC port) Removed (port has been shut down).

The following table describes the `show fcoe-map` *`map-name`* output.

Field	**Description**
Fabric-Name	Name of a SAN fabric.
Fabric ID	The ID number of the SAN fabric to which FC traffic is forwarded.
VLAN ID	The dedicated FCoE VLAN used to transport FCoE storage traffic between servers and a fabric over the NPIV proxy gateway. The configured VLAN ID must be the same as the fabric ID.
VLAN priority	FCoE traffic uses VLAN priority 3. (This setting is not user-configurable.)
FC-MAP	FCoE MAC address-prefix value - The unique 24-bit MAC address prefix that identifies a fabric.
FKA-ADV_period	Time (in seconds) used to transmit FIP keepalive advertisements.
FCF Priority	The priority used by a server to select an upstream FCoE forwarder.
Config-State	Indicates whether the configured FCoE and FC parameters in the FCoE map are valid: Active (all mandatory FCoE and FC parameters are correctly configured) Incomplete (either the FC-MAP value, fabric ID, or VLAN ID are not correctly configured).
Oper-State	Operational status of link to the fabric: Up (link is up and transmitting FC traffic) Down (link is down and not transmitting FC traffic) Link-wait (link is up and waiting for FLOGI to complete on peer FC port) Removed (port has been shut down).
Members	IOA and MXL Switch with the FC Flex IO module Ethernet and FC ports that are members of the dedicated FCoE VLAN.

show npiv devices

Display the FCoE and FC devices currently logged in to an IOA and MXL switch with the FC Flex IO module NPIV proxy gateway.

Syntax	`show npiv devices [brief]`
Parameters	`Brief` = Displays an overview of current server CNA-fabric connections.
Command Modes	• EXEC • EXEC Privilege
Command History	Version 9.3(0.0)

Example	`dell# show npiv devices brief`
	`Total NPIV Devices = 2`
	`----------`
	`ENode-Intf ENode-WWPN FCoE-Vlan Fabric-Intf Fabric-Map LoginMethod Status`
	`----------`
	`Te 0/12 20:01:00:10:18:f1:94:20 1003 Fc 0/5 fid_1003 FLOGI LOGGED_IN`
	`Te 0/13 10:00:00:00:c9:d9:9c:cb 1003 Fc 0/0 fid_1003 FDISC LOGGED_IN`
	
	See the following tables for field descriptions.

Example	`ENode[0]:`
	`ENode MAC : 00:10:18:f1:94:21`
	`ENode Intf : Te 0/12`
	`FCF MAC : 5c:f9:dd:ef:10:c8`
	`Fabric Intf : Fc 0/5`
	`FCoE Vlan : 1003`
	`Fabric Map : fid_1003`
	`ENode WWPN : 20:01:00:10:18:f1:94:20`
	`ENode WWNN : 20:00:00:10:18:f1:94:21`
	`FCoE MAC : 0e:fc:03:01:02:01`
	`FC-ID : 01:02:01`
	`LoginMethod : FLOGI`
	`Secs : 5593`
	`Status : LOGGED_IN`
	
	`ENode[1]:`
	`ENode MAC : 00:10:18:f1:94:22`
	`ENode Intf : Te 0/13`
	`FCF MAC : 5c:f9:dd:ef:10:c9`
	`Fabric Intf : Fc 0/0`
	`FCoE Vlan : 1003`
	`Fabric Map : fid_1003`

	ENode WWPN : 10:00:00:00:c9:d9:9c:cb ENode WWNN : 10:00:00:00:c9:d9:9c:cd FCoE MAC : 0e:fc:03:01:02:02 FC-ID : 01:02:01 LoginMethod : FDISC Secs : 5593 Status : LOGGED_IN See the following tables for field descriptions.
Related Command	• dcb-map • fcoe-map

The following table describes the `show npiv devices brief` output.

Field	**Description**
ENode-Intf	IOA and MXL switch with the FC Flex IO module Ethernet interface (slot/port) to which a server CNA is connected.
ENode-WWPN	Worldwide port name (WWPN) of a server CNA port.
FCoE-Vlan	VLAN ID of the dedicated VLAN used to transmit FCoE traffic to and from the fabric.
Fabric_Intf	Fabric-facing Fibre Channel port (slot/port) on which FC traffic is transmitted to the specified fabric.
Fabric-Map	Name of the FCoE map containing the FCoE/FC configuration parameters for the server CNA-fabric connection.
LoginMethod	Method used by the server CNA to log in to the fabric; for example: FLOGI - ENode logged in using a fabric login (FLOGI). FDISC - ENode logged in using a fabric discovery (FDISC).
Status	Operational status of the link between a server CNA port and a SAN fabric: Logged In - Server has logged in to the fabric and is able to transmit FCoE traffic.

The following table describes the `show npiv devices` output.

Field	**Description**
ENode [number]	A server CNA that has successfully logged in to a fabric over an IOA and MXL switch with the FC Flex IO module Ethernet port in ENode mode.
Enode MAC	MAC address of a server CNA port.
Enode Intf	Port number of a server-facing Ethernet port operating in ENode mode.
FCF MAC	Fibre Channel forwarder MAC: MAC address of IOA and MXL switch with the FC Flex IO module FCF interface.
Fabric Intf	Fabric-facing Fibre Channel port (slot/port) on which FCoE traffic is transmitted to the specified fabric.

FCoE VLAN	ID of the dedicated VLAN used to transmit FCoE traffic from a server CNA to a fabric and configured on both the server-facing IOA and MXL switch with the FC Flex IO module port and server CNA port.
Fabric Map	Name of the FCoE map containing the FCoE/FC configuration parameters for the server CNA-fabric connection.
Enode WWPN	Worldwide port name of the server CNA port.
Enode WWNN	Worldwide node name of the server CNA.
FCoE MAC	Fabric-provided MAC address (FPMA). The FPMA consists of the FC-MAP value in the FCoE map and the FC-ID provided by the fabric after a successful FLOGI. In the FPMA, the most significant bytes are the FC-MAP; the least significant bytes are the FC-ID.
FC-ID	FC port ID provided by the fabric.
LoginMethod	Method used by the server CNA to log in to the fabric; for example, FLOGI or FDISC.
Secs	Number of seconds that the fabric connection is up.
State	Status of the fabric connection: logged in.

Configuring an NPIV Proxy Gateway

Prerequisite: Before you configure an NPIV proxy gateway on an IOA or MXL switch with the FC Flex IO module, ensure the following:

- DCB is enabled by default.
- DCB (PFC and ETS) parameters are configured for converged traffic.

To configure NPG operation on an IOA and MXL switch with the FC Flex IO module, follow these steps:

1. Enable Fibre Channel capability on the switch.
2. Create a DCB map.
3. Apply a DCB map on server-facing Ethernet ports.
4. Create an FCoE VLAN.
5. Create an FCoE map.
6. Apply an FCoE map on server-facing Ethernet ports.
7. Apply an FCoE Map on fabric-facing FC ports.

Enabling Fibre Channel Capability on the Switch

You must first enable an IOA and MXL switch with the FC Flex IO module that you want to configure as an NPG for the FC protocol.

Task	Command	Command Mode
Enable an IOA and MXL switch with the FC Flex IO module for the FC protocol.	`feature fc`	CONFIGURATION

Creating a DCB Map

Configure the priority-based flow control (PFC) and enhanced traffic selection (ETS) settings in a DCB map before you can apply them on downstream server-facing ports.

Task	Command	Command Mode
Create a DCB map to specify the PFC and ETS settings for groups of dot1p priorities.	`dcb-map` *`name`*	CONFIGURATION
Configure the PFC setting (on or off) and the ETS bandwidth percentage allocated to traffic in each priority group or whether priority group traffic should be handled with strict priority scheduling.	`priority-group` *`group_num`* `{bandwidth` *`percentage`* `| strict-priority} pfc {on | off}`	DCB MAP
Specify the priority group ID number to handle VLAN traffic for each dot1p class-of-service: 0 through 7. Leave a space between each priority group number.	`priority-pgid dot1p0_`*`group-num`* `dot1p1_`*`group-num`* `dot1p2_`*`group-num`* `dot1p3_`*`group-num`* `dot1p4_`*`group-num`* `dot1p5_`*`group-num`* `dot1p6_`*`group-num`* `dot1p7_`*`group-num`*	DCB MAP

Important Points to Remember

- If you remove a dot1p priority-to-priority group mapping from a DCB map (the `no priority pgid` command), the PFC and ETS parameters revert to their default values on the interfaces on which the DCB map is applied. By default, PFC is not applied on specific 802.1p priorities; ETS assigns equal bandwidth to each 802.1p priority.
- To change the ETS bandwidth allocation configured for a priority group in a DCB map, do not modify the existing DCB map configuration. Instead, first create a new DCB map with the desired PFC and ETS settings and apply the new map to the interfaces to override the previous DCB map settings. Then delete the original dot1p priority-priority group mapping.

Applying a DCB Map on Server-Facing Ethernet Ports

You can apply a DCB map only on a physical Ethernet interface and can apply only one DCB map per interface.

Task	Command	Command Mode
Enter Interface Configuration mode on a server-facing port to apply a DCB map.	`interface {tengigabitEthernet` *`slot/port`* `| fortygigabitEthernet` *`slot/port`*`}`	CONFIGURATION
Apply the DCB map on an Ethernet port. Repeat this step to apply a DCB map to more than one port.	`dcb-map` *`name`*	INTERFACE

Creating an FCoE VLAN

Create a dedicated VLAN to send and receive FC traffic over FCoE links between servers and a fabric over an NPG. The NPG receives FCoE traffic and forwards de-capsulated FC frames over FC links to SAN switches in a specified fabric.

When you apply an FCoE map to an Ethernet port, the port is automatically configured as a tagged member of the FCoE VLAN.

Task	Command	Command Mode
Create the dedicated VLAN for FCoE traffic. The range is from 2 to 4094. VLAN 1002 is commonly used	`interface vlan` *`vlan-id`*	CONFIGURATION

to transmit FCoE traffic.		

Creating an FCoE Map

The values for the FCoE VLAN, fabric ID, and FC-MAP must be unique. Apply an FCoE map on downstream server-facing Ethernet ports and upstream fabric-facing Fibre Channel ports.

Task	Command	Command Mode
Create an FCoE map.	`fcoe-map` *`map-name`*	CONFIGURATION
Configure the association between the dedicated VLAN and the fabric where the desired storage arrays are installed. The fabric and VLAN ID numbers must be the same. The range is from 2 to 4094.	`fabric-id` *`fabric-num`* `vlan` *`vlan-id`*	FCoE MAP
Add a text description. The maximum is 32 characters.	`description` *`text`*	FCoE MAP
Specify the FC-MAP value used to generate a fabric-provided MAC address. You must enter a unique MAC address prefix as the FC-MAP value for each fabric. The range is from 0EFC00 to 0EFCFF. The default is None.	`fc-map` *`fc-map-value`*	FCoE MAP
Configure the priority used by a server CNA to select the FCF for a fabric login (FLOGI). The range is from 0 to 128. The default is 128.	`fcf-priority` *`priority`*	FCoE MAP
Enable the monitoring FIP keepalive messages (if it is disabled) to detect if other FCoE devices are reachable. The default is enabled.	`keepalive`	FCoE MAP
Configure the time (in seconds) used to transmit FIP keepalive advertisements. The range is 8 to 90 seconds.	`fka-adv-period` *`seconds`*	FCoE MAP

The default is 8 seconds.		

Applying an FCoE Map on Server-Facing Ethernet Ports

You can apply multiple FCoE maps on an Ethernet port or port channel. When you apply an FCoE map on a server-facing port or port channel:

- The port is configured to operate in hybrid mode (accept both tagged and untagged VLAN frames).
- The associated FCoE VLAN is enabled on the port or port channel.

When you enable a server-facing Ethernet port, the servers respond to the FIP advertisements by performing FLOGIs on upstream virtualized FCF ports. The NPG forwards the FLOGIs as fabric discovery (FDISC) messages to a SAN switch.

Task	Command	Command Mode
Configure a server-facing Ethernet port or port channel with an FCoE map.	`interface {tengigabitEthernet` *`slot/port`* `| fortygigabitEthernet` *`slot/port`* `| port-channel` *`num`*`}`	CONFIGURATION
Apply the FCoE/FC configuration in an FCoE map on the Ethernet port. Repeat this step to apply an FCoE map to more than one port.	`fcoe-map` *`map-name`*	INTERFACE or INTERFACE PORT_CHANNEL
Enable the port for FCoE transmission using the map settings.	`no shutdown`	INTERFACE

Applying an FCoE Map on Fabric-Facing FC Ports

The IOA and MXL switch with the FC Flex IO module FC ports are configured by default to operate in N port mode. When you apply an FCoE map on a fabric-facing FC port, the FC port becomes part of the FCoE fabric.

Each IOA and MXL switch with the FC Flex IO module FC port is associated with an Ethernet MAC address (FCF MAC address). When you enable a fabric-facing FC port, the FCoE map applied to the port starts sending FIP multicast advertisements using the parameters in the FCoE map over server-facing Ethernet ports. A server sees the FC port with its applied FCoE map as an FCF port.

Task	Command	Command Mode
Configure a fabric-facing FC port.	`interface fibrechannel` *`slot/port`*	CONFIGURATION
Apply the FCoE and FC fabric configurations in an FCoE map to the port. Repeat this step to apply an FCoE map to more than one FC port.	`fabric` *`map-name`*	INTERFACE FIBRE_CHANNEL
Enable the port for FC transmission.	`no shutdown`	INTERFACE FIBRE_CHANNEL

You can apply a DCB or FCoE map to a range of Ethernet or Fibre Channel interfaces by using the `interface range` command; for example:

```
Dell(config)# interface range tengigabitEthernet 1/12 - 23 ,
tengigabitEthernet 2/24 – 35
Dell(config)# interface range fibrechannel 0/0 - 3 ,
fibrechannel 0/8 – 11
```

Enter the keywords `interface range` then an interface type and port range. The port range must contain spaces before and after the dash. Separate each interface type and port range with a space, comma, and space.

Sample Configuration

1. Configure a DCB map with PFC and ETS settings.

   ```
   Dell(config)# dcb-map SAN_DCB_MAP
   Dell(config-dcbx-name)# priority-group 0 bandwidth 60 pfc
   off
   Dell(config-dcbx-name)# priority-group 1 bandwidth 20 pfc
   on
   Dell(config-dcbx-name)# priority-group 2 bandwidth 20 pfc
   on
   Dell(config-dcbx-name)# priority-pgid 0 0 0 1 2 0 0 0
   ```

2. Apply the DCB map on a downstream (server-facing) Ethernet port.

   ```
   Dell(config)# interface tengigabitethernet 1/0
   Dell(config-if-te-0/0)#dcb-map SAN_DCB_MAP
   ```

3. Create the dedicated VLAN to be used for FCoE traffic.

```
Dell(conf)#interface vlan 1002
```

4. Configure an FCoE map to be applied to the downstream (server-facing) Ethernet and upstream (core-facing) FC ports.

```
Dell(config)# fcoe-map SAN_FABRIC_A
Dell(config-fcoe-name)# fabric-id 1002 vlan 1002
Dell(config-fcoe-name)# description "SAN_FABRIC_A"
Dell(config-fcoe-name)# fc-map 0efc00
Dell(config-fcoe-name)# keepalive
Dell(config-fcoe-name)# fcf-priority 128
Dell(config-fcoe-name)# fka-adv-period 8
```

5. Enable an upstream FC port.

```
Dell(config)# interface fibrechannel 0/0
Dell(config-if-fc-0)# no shutdown
Dell (config-if-fc-0)# fabric SAN_FABRIC_A
```

6. Enable a downstream Ethernet port.

```
Dell(config)#interface tengigabitEthernet 0/0
Dell(conf-if-te-0)# no shutdown
Dell (conif-if-te-0)# fcoe-map SAN_FABRIC_A
```

Displaying NPIV Proxy Gateway Information

To display NPG operation information, use the following `show` commands.

Command	Description
`Show interfaces status`	Displays the operational status of Ethernet and Fibre Channel interfaces.
`show fcoe-map [brief | map-name]`	Displays the FC and FCoE configuration parameters in FCoE maps.
`show qos dcb-map map-name`	Displays the configuration parameters in a specified DCB map.
`show npiv devices [brief]`	Displays information on FCoE and FC devices currently logged in to the NPG.
`show fc switch`	Displays the FC mode of operation and worldwide node (WWN) name.

For more information about NPIV Proxy Gateway information, refer to the *9.3(0.0) Addendum*.

IOA PMUX Mode CLI Commands

The following tables list the IOA PMUX mode CLI commands that you can access without a separate user profile. For more information about these commands, refer to the *Addendum for Dell Networking OS 9.3(0.0)* or the *PowerEdge M IO Aggregator Command Line Interface for Dell Networking OS version 9.2(0.2)/9.2(0.0)*.

Data Center Bridging (DCB) CLI Commands

advertise dcbx-appln-tlv	advertise dcbx-tlv
Dcb-map	dcb enable
dcb stack-unit all pfc-buffering pfc-port-count pfc-queues	dcb stack-unit pfc-buffering pfc-port-count pfc-queues
dcbx port-role	dcbx version
iscsi priority-bits	description
pfc mode on	fcoe priority-bits
pfc priority	Priority-pgid
priority-group	pfc no-drop queues
show interface dcbx detail	scheduler
show interface pfc	show dcb
Show qos dcb-map	show interface ets
show stack-unit stack-ports pfc details	show interface pfc statistics
show stack-unit stack-ports ets details	

FIP Snooping CLI Commands

clear fip-snooping database interface vlan	clear fip-snooping statistics
feature fip-snooping	fip-snooping enable
fip-snooping fc-map	fip-snooping port-mode fcf

High Availability (HA) CLI Commands

redundancy force-failover	show redundancy

Internet Small Computer System Interface (iSCSI) Optimization CLI Commands

advertise dcbx-app-tlv	iscsi aging time
iscsi cos	iscsi enable
iscsi priority-bits	iscsi profile-compellant

iscsi target port	

Interfaces CLI Commands

clear counters	interface
flowcontrol	interface range
interface ManagementEthernet	mtu
interface vlan	portmode hybrid
negotiation auto	channel-member
interface port-channel	minimum-links
Vlan tagged	Vlan untagged
description	

Internet Group Management Protocol (IGMP) CLI Commands

ip igmp group-join-limit	ip igmp last-member-query-interval
ip igmp querier-timeout	ip igmp query-interval
ip igmp query-max-resp-time	ip igmp version
ip igmp snooping enable	ip igmp snooping fast-leave
ip igmp snooping last-member-query-interval	ip igmp snooping mrouter
ip igmp snooping querier	

Layer 2 CLI Commands

mac-address-table aging-time	mac-address-table static
mac-address-table station-move refresh-arp	

Link Aggregation Control Protocol (LACP) CLI Commands

lacp long-timeout	lacp port-priority
port-channel mode	port-channel-protocol lacp

Link Layer Discovery Protocol (LLDP) CLI Commands

advertise dot1-tlv	advertise dot3-tlv
advertise management-tlv	clear lldp counters
clear lldp neighbors	debug lldp interface
disable	hello
mode	multiplier

Quality of Service (QoS) CLI Commands

dot1p-priority	rate shape
service-class dynamic dot1p	service-class dot1p-mapping
service-class bandwidth-	bandwidth-percentage

percentage	
clear qos statistics	description
policy-aggregate	policy-map-output
qos-policy-output	rate police
rate shape	service-policy output
service-queue	set
show qos policy-map	wred
wred-profile	

Simple Network Management Protocol (SNMP) CLI Commands

snmp-server enable traps	snmp-server host
clear logging	logging
logging buffered	logging console
logging monitor	logging source-interface
show logging	show logging driverlog stack-unit
terminal monitor	

Storm Control CLI Commands

show storm-control unknown-unicast	storm-control broadcast (Configuration)
storm-control multicast (Configuration)	storm-control broadcast (Interface)

Uplink Failure Detection (UFD) CLI Commands

clear ufd-disable	debug uplink-state-group
description	downstream
downstream auto-recover	downstream disable links
enable	show running-config uplink-state-group
show uplink-state-group	uplink-state-group
upstream	

Virtual Link Trunking (VLT) CLI Commands

back-up destination	clear vlt statistics
peer-link port-channel	lacp ungroup member-independent
show vlt mismatch	unit-id
vlt domain	vlt-peer-lag port-channel